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(54) Apparatus for counting a number of paper sheets

(57) An apparatus for counting a target number of paper sheets is described in which the target number entered by an entry unit (2a,2b,2c) is stored in a target number memory (12) and displayed in a target number display section (4a), the count number supplied from a sensor and counter section (3b) since the time of start of counting is displayed in a count number display section (4b) and

compared to said target number, and the counting number is discontinued in case of coincidence between said count number and the target number. According to the invention, the entry section has a batch key (2a), a plus key (2b) and a minus key (2c). A gross or an approximate number (say, 10, 20, 50 or 100) is entered by the batch key (2a) and incremented or decremented by the

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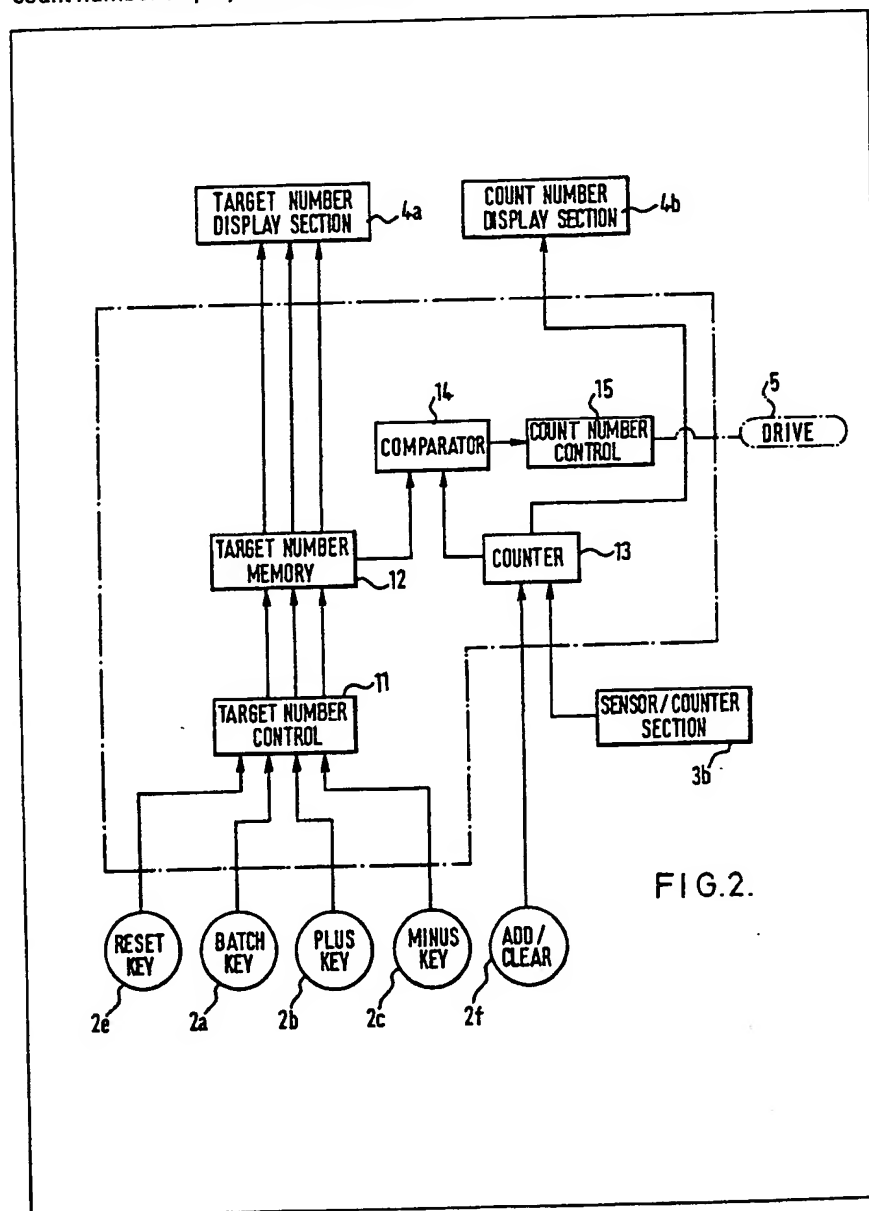


FIG.2.

plus key (2b) or minus key (2c) by one at a time for adjustment of the gross number to the desired target number. When the gross number is the infinite number, a continuous counting operation is performed until depletion of the paper sheets.

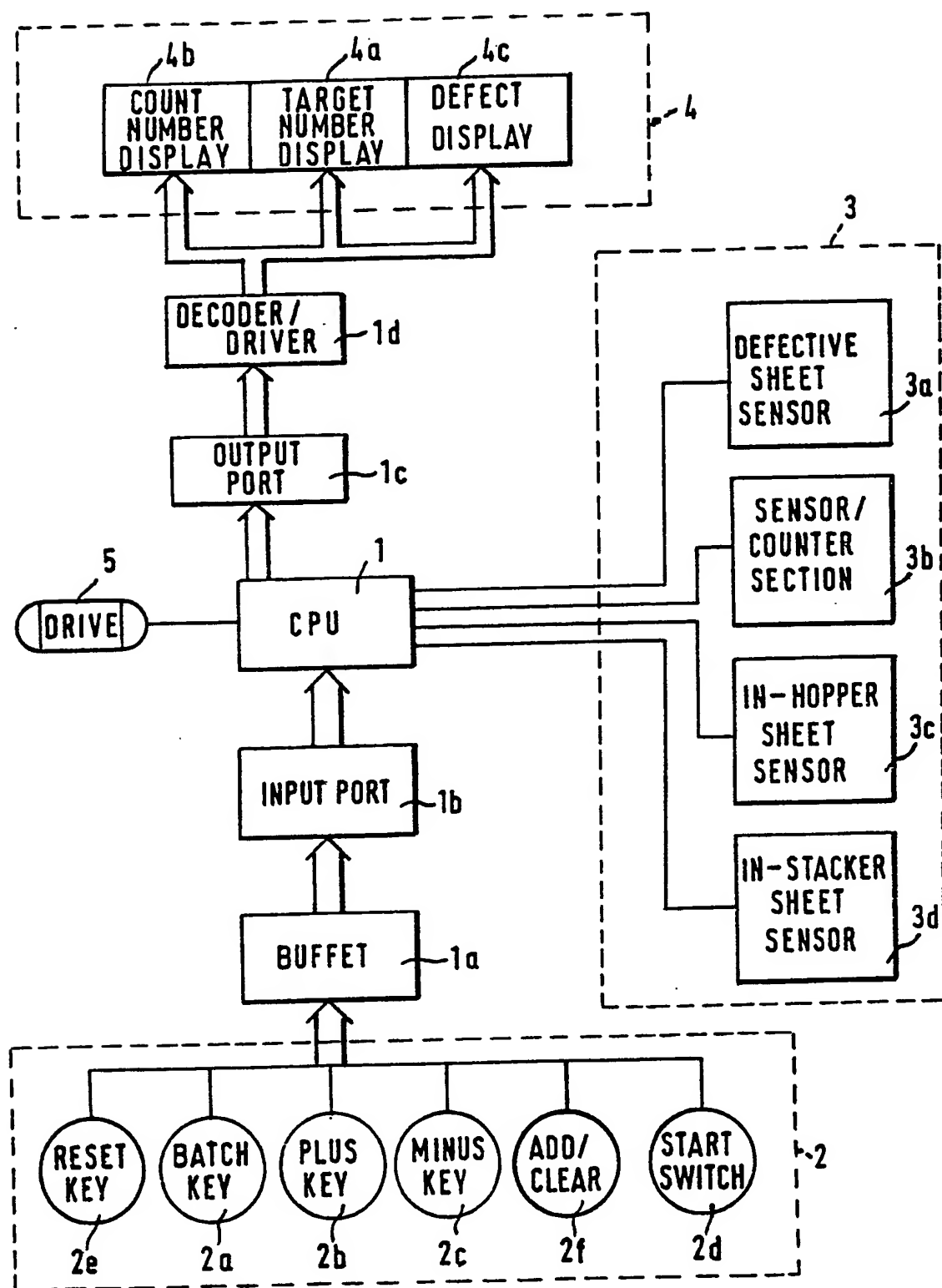


FIG.1.

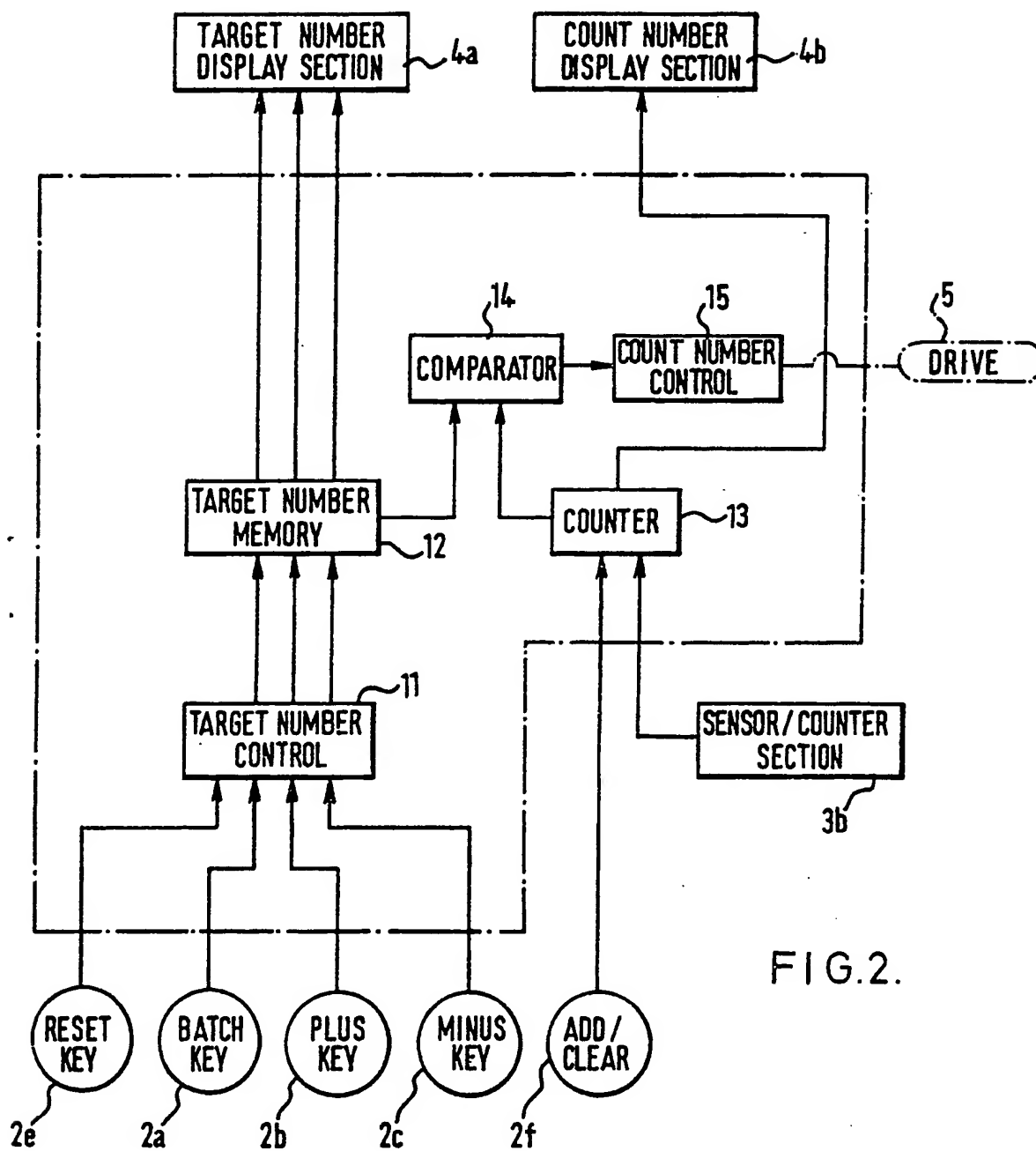


FIG. 2.

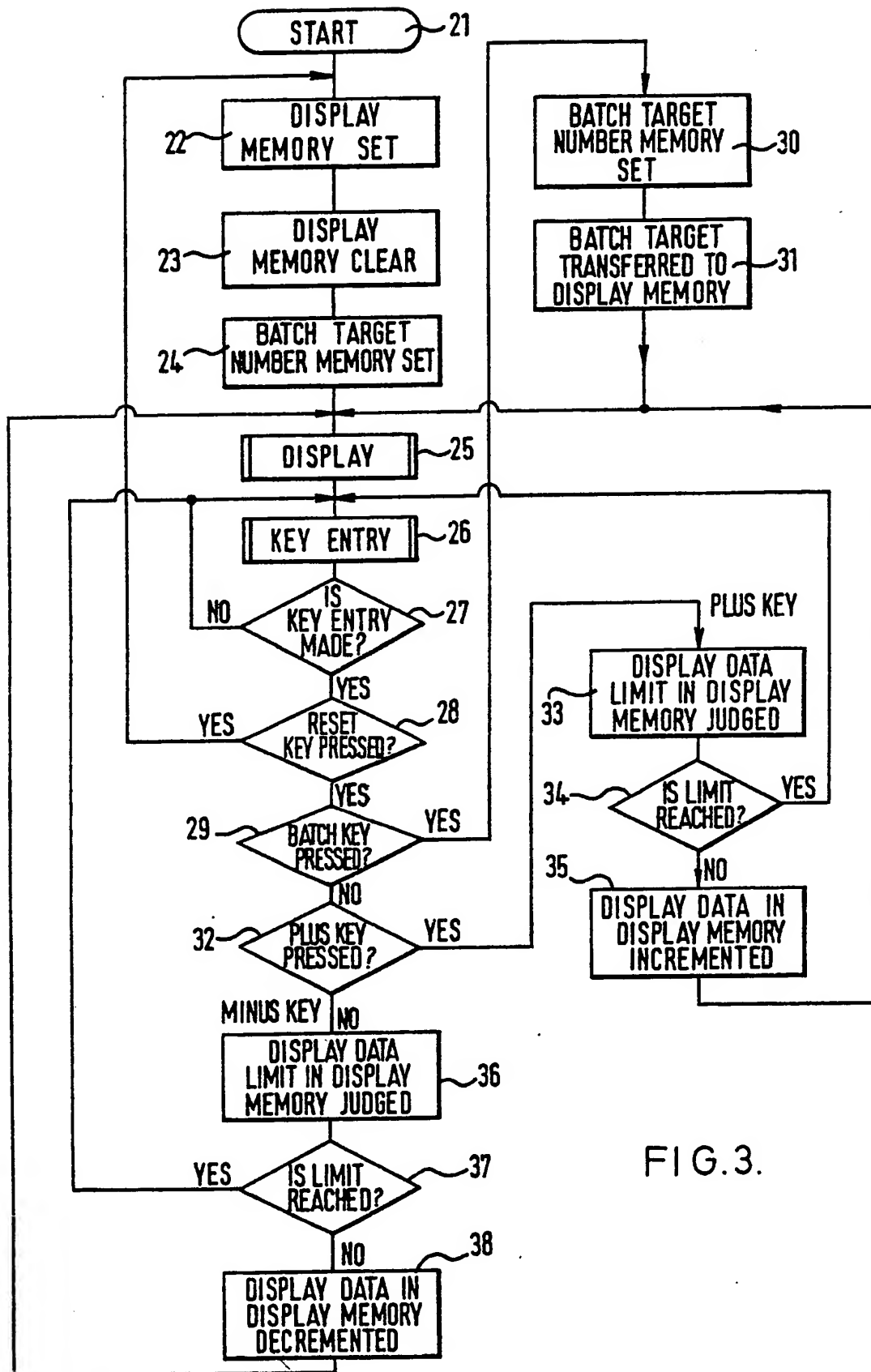


FIG. 3.

## SPECIFICATION

## Apparatus for counting a number of paper sheets

5 This invention relates to an apparatus for counting a number of paper sheets.

Known apparatus of this type is used for counting the number of banknotes, voting cards, checks or bills. In general, the methods of counting the sheets may be variable with the objective of counting. For example, a method of continuous counting may be employed when it is desired to obtain the total number of paper sheets in subject or to ascertain that the actual number of paper sheets is equal to the indicated value. On the other hand, batch counting may be resorted to when the paper sheet in subject are to be arranged in bundles or batches each containing a predetermined number of the sheets.

An apparatus of this type is described for instance in our copending Japanese Laid-Open Patent Specification No. 58-6023 entitled "Apparatus for Counting the Number of Voting Cards" filed on July 3, 1981. In a method of batch counting or voting cards disclosed in said Patent Application, the number of the voting cards making up each bundle or batch and stored in the memory of the counting apparatus is entered by a knob to a desired one of a plurality of predetermined values such as 10, 20, 50, 100, 200 and infinity ( $\infty$ ). The counting apparatus disclosed in said Patent Application is so designed and constructed that condition judgement signals or count number signals from the associated sensors are used to display the presence of defective cards or defective transfer states as the above signals are transferred through the memory, comparator or control units.

In the aforementioned counting apparatus, the number of paper sheets once entered by the knob for the batch operation is fixed and it is impossible to enter an arbitrarily selected number other than such fixed value. Thus the apparatus is not applicable to counting the number of paper sheets in general. For entering an arbitrarily selected number, it is also known to use a ten-key board in place of the entry knob and to designate the desired number by selective actuation of the numerical keys. The number thus entered is stored in a memory and occasionally compared to the actual count number and a count terminating signal is issued when there is a coincidence between the target number and the count number. With such ten-key boards, it is impossible to reduce the overall size of the apparatus because of structural requirements. In addition, the operation of the apparatus is complicated because the same number of keys as that of the digits need be actuated each time a new target is entered in the apparatus.

A counting apparatus is also known in which the display in the count number display unit in the magnetic counter is incremented and the display in the number entry unit operatively geared to said count number display unit is decremented with each passage of a banknote, and in which the counting operation is terminated when the preset number in the entry unit is nil. With this apparatus, the

operation is complicated because it is necessary to disconnect the display unit from the entry unit each time a new target number is set and to connect the two units after setting the new target number. Any error caused in the connecting and disconnecting process may lead to destruction of the counter units. In addition, with this counting apparatus, it is impossible to reduce the overall size of the apparatus or to elevate the rate of counting because of structural constraints.

According to the present invention there is provided an apparatus for counting a number of paper sheets comprising means to store a target number, entered by an entry unit, in a target number memory for display in a target number display section, means to display a paper sheet count number supplied from a sensor and counter section since a time of start of a counting operation in a count number display section and to compare it to said target number, and means to discontinue the counting operation in case of coincidence between said count number and the target number, said entry section having a batch key, a plus key and a minus key, said target number memory having stored therein, in use, a predetermined number of fixed data that are displayed cyclically during the time said batch key is operated, means to discontinue the cyclic display upon termination of the batch key operation, means to enter one of said fixed data prevailing at the time of termination of the batch key operation in said target number memory, means to increment or decrement the fixed data thus entered in said target number memory by one each time said plus or minus key respectively is operated, the incremented or decremented data prevailing when the plus or minus key is entered as said target number, and means to compare the target number thus entered to the count number from said sensor and counter section.

A microprocessor may be used as an arithmetic operation unit for reducing the overall size of the apparatus.

The invention will be described by way of example with reference to the accompanying drawings, wherein:-

*Figure 1* is a block diagram schematically showing an apparatus embodying the present invention; *Figure 2* is a block diagram showing the inside of a central processing unit; and

*Figure 3* is a flowchart for illustrating the operation of the unit shown in *Figure 2*.

In *Figure 1*, there is illustrated schematically an operating circuit of a paper sheet counting apparatus embodying the present invention. Various signals from an operating part 2 and a sensor part 3 are inputted through a buffer 1a and an input port 1b to a central processing unit or CPU 1, where these signals undergo comparison or an arithmetic operation for controlling the operation of a driving part 5 which is designed to feed out the paper sheets for counting. Simultaneously, those signals are applied to a display part 4 for display through an output port 1c and a decoder/driver circuit 1d.

The target number of sheets entered by keys 2a, 2b and 2c is transferred through CPU and displayed on a target number display part 4a. Then, upon

actuation of a start switch 2d, the paper sheets placed in a hopper, not shown, are fed out one by one by the driving unit 5 to be stacked on a stacker, also not shown. Each paper sheet thus fed out is sensed by a sensor/counter 3b of the sensor unit 3, and the resulting sensor/counter signals are supplied to CPU 1, while the corresponding count number is displayed in a count number display part 4b. When the target number in the display part 4a is coincidence with the count number in the display part 4b, the CPU 1 detects this state to deactivate the driving unit 5.

A defective sheet sensor part 3a operates to check the state of paper being transferred to find out those defective sheets which may lead to counting errors. For example, when two or more superposed or consecutive sheets or halved sheets are detected, this state is displayed on a defect display part 4c while the operation of the driving unit 5 is halted.

The operating circuit in the CPU 1 of the counting apparatus shown schematically in Figure 2 in greater detail. Since the defective sheet sensor part 3a and the defective sheet display part may be similar to those shown in the said Japanes Laid-Open Patent Specification No. 58-6023, they are not shown in Figure 2. In this Figure, signals from a batch key 2a, a plus key 2b and a minus key 2c are supplied to a target number control unit 11 which then operates an output data stored in a target number memory 12 to a target number display 4a for display. Simultaneously, these data are supplied to a comparator 14. The count number signal from the sensor/counter 3b is supplied to a counter 13. The count number signal from the counter 13 is outputted to the count number display part 4b for display and to the comparator 14. Signals from an add/clear changeover switch 2f are also supplied to the counter 13 which then operates to sum the count numbers for respective batch operations when the switch 2f is levelled to add and to clear the count number display upon termination of the respective batch operations when the switch 2f is levelled to clear.

The comparator 14 compares the target number signal from the target number memory 12 to the count number from the counter 13, and outputs a coincidence signal to a count number control unit 15 when the two signals coincide with one another. The control part 15 outputs a stop signal to the driving unit 5.

The operation of CPU for display of the number of paper sheets shown in Figure 2 is described below by referring to a flow chart shown in Figure 3. The operation is started upon connection to a power source (block 21). When the operation is started, a display memory in the target number memory 12 is reset to zero while it is activated for data storage (blocks 22, 23). A batch target number memory in the memory 12 is also activated for data storage (block 24). Fixed data for target numbers such as 100, 50, 20, 10 and infinity (oo) are stored in this batch target number memory. In initial state, zero is displayed in the target number display unit 4a (block 25). Next, a selected one of batch key 2a, plus key 2b, minus key 2c or reset key 2c is pressed (blocks 26 and 27).

When the reset key 28 is pressed, the display in the display unit 4a is cleared ("yes" in block 28). When the batch key 2a is pressed (block 29), the fixed data 100, 50, 20, 10 and infinity (oo) stored in the batch target number memory are transferred sequentially into the aforementioned display memory, and are displayed cyclically in the display part 4a (blocks 30, 31). When the manual pressure on the display memory 12 is released, the current one of the fixed data is stored in the display memory and displayed in the display part 4a.

When the plus key 2b is pressed subsequently, the number as set by the batch key 2a is incremented by one. When the manual pressure on the plus key is released the incremented number is displayed (blocks 32, 33, 34, 35). When the minus key 2c is pressed, the displayed target number is decremented by one. When the manual pressure on the key is released, the decremented number is displayed ("no" in block 32). A certain limitation (for example, 100) is provided to the increment or decrement operations to be performed with the plus or minus keys and these operations are discontinued in the event that the key operations should cause this limit to be exceeded (blocks 34, 37).

In this manner, the desired target number of paper sheets is stored in the target number memory 12. This number is also supplied to the comparator 14 as mentioned hereinabove.

In the case of a continuous counting operation, an infinity mark oo is displayed by batch key 2a in the display part 4a. By this, the comparator 14 is disabled to check for coincidence between the signal from the counter 13 and the signal from the target memory 12 so that the counting operation is continued until depletion of the paper sheets stored in the hopper for counting. The batch counting operation can be performed with the desired target number of the paper sheets displayed in the display part 4a by using the batch key and the plus or minus key.

In the above embodiment, start switch 2d is pressed for starting the counting. However, this start switch may be replaced by a manual/auto changeover switch so that the switch acts in the same manner as start switch 2d when set to manual, and the automatic counting operation may be started when the switch is set to auto. In the latter case, the automatic counting may be initiated by taking the AND of a signal from an in-hopper sheet sensor 3c indicating the presence of the paper sheets in the hopper, a signal from an in-stacker sheet sensor 3d indicating the absence of the paper sheets in the stacker and a signal indicating termination of target number entry and display operations.

The various operations described in the foregoing may be taken charge of by a microprocessor to provide a paper sheet counting apparatus which is extremely small in size and hence can be handled conveniently.

## CLAIMS

1. An apparatus for counting a number of paper sheets comprising means to store a target number,

entered by an entry unit, in a target number memory for display in a target number display section, means to display a paper sheet count number supplied from a sensor and counter section since a time of start of a counting operation in a count number display section and to compare it to said target number, and means to discontinue the counting operation in case of coincidence between said count number and the target number, said entry section having a batch key, a plus key and a minus key, said target number memory having stored therein, in use, a predetermined number of fixed data that are displayed cyclically during the time said batch key is operated, means to discontinue the cyclical display upon termination of the batch key operation, means to enter one of said fixed data prevailing at the time of termination of the batch key operation in said target number memory, means to increment or decrement the fixed data thus entered in said target memory by one each time said plus or minus key respectively is operated, the incremented or decremented data prevailing when the plus or minus key is entered as said target number, and means to compare the target number thus entered to the count number from said sensor and counter section.

2. An apparatus as claimed in claim 1, wherein said fixed data include an infinite number (oo) and wherein a continuous counting operation is performed when the infinite number is entered in said target number memory as said fixed data.